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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/038,800	12/31/2001	Ching-Tien Ma	67,200-549	2943

7590 12/12/2003

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EXAMINER	
BARRECA, NICOLE M	
ART UNIT	PAPER NUMBER
1756	

DATE MAILED: 12/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/038,800	MA ET AL.	
	Examiner	Art Unit	
	Nicole M. Barreca	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 October 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *31 December 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. Claims 1-15 are pending in this application.

2. The objection to claim 12 has been withdrawn in response to the applicant's amendment.

3. The 35 USC 103 rejection of claims 9-15 over Shields in view of Jain has been withdrawn in response to the applicant's amendment to claim 9. Claims 9-15, as amended, are now rejected over Shields in view of Suzuki.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-6, 8-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shields (US 2001/0045646) in view of Suzuki (US 5,783,459).

Shields discloses the use of a SiON ARC/hard mask for interconnection metal patterning that will not interact with conventional deep UV resist processing at about 100-300 nm [0014]. Figure 3 illustrates dielectric layer 30 (substrate) and conductive layer 32. A SiON ARC/hard mask 34 (etch stop) is deposited on the conductive layer followed by a thin oxide layer 36 (dielectric or insulating) and photoresist pattern mask 38. The photoresist mask comprises a DUV photoresist material (cl.8 on p.3). Etching is conducted to pattern the conductive layer. The oxide and silicon oxynitride layers are removed after etching (cl.4 on p.3). The SiON is formed at a thickness of about 300-

700 angstroms, the oxide layer at a thickness of about 20-300 angstroms, while the photoresist is formed at a thickness of about 7000-9000 angstroms. The conductive layer comprises a barrier metal at a thickness of about 250-750 angstroms and a metal layer at a thickness of about 400-8000 angstroms [0024]-[0025]. The total height of the stack (using the median thickness for all layers) is about 13,360 angstroms or 1.336 microns. The method is able to produce features of about 0.15 microns [0026], giving an aspect ratio (pattern height/pattern width) of about 8.9.

Shields does not disclose curing the photoresist with UV radiation for at least one minute, for a time period between about one minute and about 10 minutes (cl.5,14), or for a time period between about one minute and about 10 minutes at a temperature of at least 100 °C (cl.6). Suzuki teaches a method for patterning a metal layer wherein the photoresist is cured with UV radiation in order to reduce the amount of decomposed polymer on the pattern resist (abstract). Resist layer 41 is cured by being subjected to curing UV rays radiated onto the resist pattern 41 in order to prevent decomposed polymer from being produced on the resist pattern during the metal dry etching step carried out with reactive gas including chlorine. The curing UV rays are radiated onto the resist pattern at a temperature of 100-170 °C for approximately 90 seconds. The curing UV rays are from 180 nm to 330 nm. The cured resist pattern does not react the aluminum trichloride in the metal dry etching step and no polymer film is formed (col.6, 1-46). It would have been obvious to one of ordinary skill in the art to cure the photoresist in the method of Shields with UV radiation for about 1-10 minutes at a temperature of at least 100 °C because Suzuki teaches that curing a resist using UV

radiation at about 100-170 °C for approximately 90 seconds will prevent the formation of a polymerized film from being produced on the resist during the metal etching step.

6. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shields in view of Suzuki as applied to claim 1 above, and further in view of Hsia (US 6,162,724).

Since Suzuki etches the metal layer using a reactive gas including chlorine species, the reference is concerned with preventing the production of a chlorocarbon polymer film and therefore does not disclose reducing the fluorocarbon polymer formation by performing a UV cure. Hsia teaches that in a conventional metallization process, it is known that a chemical compound film will be formed on the metal layer during the etching process as a result of a reaction between the hydrocarbon polymers of the photoresist and the chlorine or fluorine molecules contained in the reactive ion etching chemicals (col.2, 25-36). It would have been obvious to one of ordinary skill in the art that if a reactive gas including a fluorine species was used to etch the metal layer in the method of Suzuki, instead of a reactive gas including a chlorine species, that the UV cure would reduce the fluorocarbon polymer formation (instead of reducing the chlorocarbon polymer film) because Hsia teaches that it is known that both the chlorine and fluorine species used in a conventional metal etch will react with the hydrocarbon polymer of the resist and form a chemical compound film.

Response to Arguments

7. Applicant's arguments, with respect to claims 1-8, filed 10/23/03 have been fully considered but they are not persuasive.

With respect to the USC 103 rejection of claims 1-6 and 8 over Shields in view of Suzuki and the USC 103 rejection of claim 7 over Shields, Suzuki and further in view of Hsia, the applicant argues that Shields uses a thin silicon oxide layer on top of the silicon oxynitride layer, while the applicant uses a thicker silicon oxide layer. However the applicant has no claims which limit the thickness of this layer. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a process for forming a deep via with large aspect ratios) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Claim 1 as written recites in the preamble "A method for forming via or contact holes with improved aspect ratios" and has no recitation of a method for forming "a deep via with large aspect ratio". Even if these argued limitations were recited in the rejected claims, "deep" and "large" are relative terms which would not impart any specific limitation or meaning to the claims, unless accompanied with a defining numerical range and/or a specific numerical definition of these terms in the specification. The only claim which specifies an aspect ratio is claim 2, which recites that the via or contact holes have an aspect ratio of at least 8. This limitation is taught by Shields, as discussed in the preceding USC 103 rejection, "The total height of the stack (using the median thickness for all layers) is about 13,360 angstroms or 1.336 microns. The method is able to produce features of about 0.15 microns [0026], giving an aspect ratio (pattern height/pattern width) of about 8.9." The examiner used the

applicant's definition of aspect ratio given on p.2 of the specification as the ratio between the depth of the opening and the diameter.

8. Applicant's arguments with respect to claims 9-15 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicole M. Barreca whose telephone number is 703-308-7968. The examiner can normally be reached on Monday-Thursday (8:00 am-6: 30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 703-308-2464. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

12/9/03

Nicole Barreca

NICOLE BARRECA
PATENT EXAMINER
Art Unit 1756